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Photo-Mechanical Process

Charles Frederick

By C. F. CHANDLER, Ph.D., LL.D.

PREPARED FOR THE EXHIBITION OF PICTURES
MODERN MECHANICAL PHOTOGRAPHIC
PROCESSES,

HELD BY

THE NEW YORK CAMERA CLUB

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PHOTO-MECHANICAL PROCESSES.

By Prof. CHAS. F. CHANDLER, Ph.D., LL.D.

THE TERM "PHOTO-MECHANICAL" is given to all processes in which, by the aid of light, in connection with chemical and mechanical treatment, printing surfaces are prepared which can be used for multiplying impressions without the further aid of light.

Nicephore Niepce was the first to devise a photo-mechanical process. Some time prior to 1827 he succeeded in producing etched metallic plates, using the bitumen of Judea as his resist. This substance is rendered insoluble by light, and by coating metallic plates with it, exposing them in the camera and fixing with oil of lavender, Niepce obtained a reversed picture in bitumen on metal. That is, where the high lights fell on the plate the bitumen remained, having been rendered insoluble in the oil of lavender, by the action of the light. Where the shadows fell the bitumen retained its solubility and was washed away in the fixing process. On applying an etching agent the unprotected metal was attached and dissolved and the positive picture was corroded into the surface, as in ordinary etching. On cleaning the plate it could be used for printing in the same manner as a plate etched in the usual way, from a drawing in wax, made by hand. The pictures were called Heliographs. The process of Niepce was not a success, as the pictures were indistinct and wanting in sharpness, and nothing further was accomplished in the art of photography till 1839, when Daguerre announced his great discovery of the Daguerreotype.

These pictures were taken on silvered copper, and it was soon found that electrotypes could be made from them which would show the picture in relief. These reliefs were not, however, sufficiently deep or sharp for practical use with printer's ink.

It was the development of Talbot's invention of the negative that finally revived photo-mechanical work, and made it possible to secure satisfactory results. Talbot, in 1839, made paper negatives.

Niepce de St. Victor invented glass negatives in 1848, using albumen as the vehicle for the silver salts.

In 1851 Frederick Scott Archer published his collodion process for making negatives, which marks the beginning of a new era in photography, and which made photo-mechanical processes practicable. The ordinary collodion negative, properly intensified, left little to be desired for line work, such as copying engravings, drawings, &c., and for some photo-mechanical processes it was entirely satisfactory for half-tone work; and portraits, landscapes, &c., could be readily reproduced by it. This is true of the Woodburytype, Albertype, Artotype, Indotint, Heliotint, Photo-gravure and Aquatint processes. These negatives were, however, found inadequate for reproducing a properly graded surface for lithographic or typographic printing.

Various methods were suggested for producing a *grained* surface on stone or metal. Some of these processes involve a preparation of the surface, but the most successful depend upon a peculiar grained negative, in which the picture is broken up into lines, dots or stipples. Among the inventors of half-tone negatives the names of J. W. Swan, Egloffstein, Woodbury, Petit, F. E. Ives and Meisenbach are most prominent.

Success in photo-mechanical processes depends upon the use of substances which are sensitive to light, and which are used to produce, photographically, the design either flat for etching or direct printing, or in relief for moulding, for electrotyping, stereotyping, &c.

Bitumen or asphaltum was first used by Niepce (1827); chromatized gelatin, albumen and gum arabic by Talbot (1852), for etched plates ; and chromatized gelatin was first used for transfers, and for reliefs for electrotyping and stereotyping by Paul Pritsch in 1854.

CLASSIFICATION OF PHOTO-MECHANICAL PROCESSES.

I. Those in which the picture is moulded in gelatine colored by a pigment.
  1. Woodburytype or photoglyph.

II. Those in which the picture is printed in printing ink.

  A. Collotype processes (Lichtdruck, Phototype,) in which the picture is printed from a gelatine surface.
    1. Albertype.
    2. Artotype.
    3. Indotint or Autoglyph.
    4. Heliotype.
    5. Leimtype.

  B. Processes in which the picture is printed from stone.
    1. Photo-lithograph.
    2. Photo-caustic.
    3. Ink photo.

C. Processes in which the picture is printed from a metallic relief surface: "typographic or block printing."
- *a.* Swelled gelatine processes.
  1. Photo-electrotype (copper).
  2. Photo-engraving (type metal).
- *b.* Photo-etchings.
  1. Photo-zincograph (by transfer).
  2. Zincotype (direct photo on plate with albumen or bitumen).
  3. Typogravure (copper).
  4. Chromo-typogravure (several plates).

D. Processes in which the picture is printed from an intaglio copper plate.
1. Photo-gravure
2. Photo-aquatint.
3. Goupil-gravure.

WOODBURYTYPES.

The Woodburytype or Photoglyph was invented by W. B. Woodbury. A sheet of bichromatized gelatine is exposed under a negative; it is then washed to remove the unchanged gelatine that was protected from the light by the negative, and finally dried. This relief film is then placed upon a sheet of lead and forced into it by hydraulic pressure, thus producing an intaglio mould.

This mould is placed in a horizontal press and flowed with a solution of warm gelatine colored with pigment. A sheet of paper is then laid upon it, and the excess of colored gelatine is forced out by pressure. The paper print is hardened in a solution of alum. The result is a gelatine pigment picture. A sheet of glass is sometimes substituted for the paper, and transparencies and lantern slides of great beauty are obtained.

The *Stannotype* is a modification in which tin foil, properly backed by electrotyping or otherwise, is substituted for the lead plate.

The *Photo-filigrane* or *Photo-diaphanic* process consists in attaching the gelatine relief to a plate of steel and using it to produce, by pressure, transparencies in white paper, which resemble water-marks.

ALBERTYPES.

Joseph Albert, of Munich, in 1869, devised this most successful process for reproducing photographs in printer's ink.

A sheet of plate glass is coated with a thin film of chromatized albumen and gelatine, laid face down on black velvet and exposed to light. It is then washed and dried. The insoluble film adheres firmly to the glass and serves as a foundation for the second film, which consists of chromatized gelatine. This is exposed under a negative which has been reversed by stripping. The plate is then soaked in water to remove the soluble bichromate, the film is hardened with chrome alum and then dried. The result is an almost invisible picture in gelatine, which has become insoluble in water, and actually repellent for water ; while the gelatine which was protected by the negative (the whites) retains its absorbing power.

The plate is fastened by plaster-of-paris to the bed of the press, and the printing is then conducted very much as in ordinary lithography. A wet sponge is applied to moisten the whites, and an ink roller to ink the picture. A sheet of paper is placed on the surface, and on applying pressure the ink is transferred to the paper. The picture may also be printed on linen, silk, &c.

ARTOTYPES.

Obernetter, of Munich, invented this improvement on the Albertype in 1878. He uses a mixture of albumen and soluble glass for the foundation film, on which the sensitive film is afterward placed. As this film does not require to be hardened by light, opaque metallic plates may be substituted for the plate glass of the Albertype; otherwise the process is substantially identical with that of Albert.

INDOTINTS.

In this process, invented by T. C. Roche, of New York, the plate, usually of copper, is roughened or pitted by exposure to the sand-blast, in order to cause the sensitive film to adhere tenaciously. Extra toughness and tenacity are also produced in the film by the addition of alcohol to the chromatized gelatine. After exposure under the negative, the unchanged bichromate is washed out and the plate is dried. These plates can be used in the power press, and 1000 copies an hour may be printed from them.

HELIOTYPES.

Between the years 1869 and 1872, Ernest Edwards, formerly of London, now of New York, made a number of improvements in collotype printing which resulted in the Heliotype. The most important features of the improvements are the hardening of the gelatine film by chrome alum, and the detaching of it from the support upon which it is first prepared. When completed it is a thin sheet or "skin" of gelatine, tough and flexible. For printing it may be placed on a plate of zinc, or it may be attached to a cylinder. It may be preserved and used for printing, as occasion may demand.

COLLOTYPES IN COLORS.

Albert, Bierstadt, Frisch and others have succeeded in producing very beautiful pictures in colors, by preparing several gelatine plates, each plate bearing particular parts of the picture, and being used for printing the appropriate colored ink. As many as seven different plates are employed successively in producing the picture.

There are different methods in use for preparing the several plates.

One plan is to make a separate negative for each color. This is accomplished by interposing a suitable screen of colored glass, or colored liquid, between the object and the photographic plate in the camera. For example, a screen which shuts out all colors except blue will permit only the blue portions of the picture to be photographed on the negative, and a gelatine plate from this negative may be used for printing with blue ink. In a similar way another screen will furnish a negative and plate for the red portions of the picture, and so on.

Another plan is to prepare the gelatine plates from one and the same negative by " stopping out " all of the picture except that of one color.

LEIMTYPES.

In 1887, Husnik, of Prague, invented a process for preparing high relief plates of gelatine that can be used for typographic printing in an ordinary printing press, either for the reproduction of pictures or letterpress. Husnik uses a thick plate of chromatized gelatine and exposes it under a negative as usual. He then attaches this by means of gutta percha to zinc or wood, thus making a firm but somewhat elastic foundation for the printing surface. He then develops the surface by treatment with a solvent, such as a saturated solution of an alkaline bichromate. This not only dissolves the gelatine upon which the light did not fall, but it also deepens and strengthens the relief. The development is stopped before any of the finest lines or dots are injured. The plate is dried and the lights are covered with a solution of opaque printer's ink, by means of a camel's hair brush. The plate is then exposed for a second time to the action of light, by which it is hardened and strengthened, not only on the surface, but also on the flanks of each line and dot. The black is then removed and the solvent is again applied to deepen the whites. These plates may be used directly in the press, and will print 100,000 copies. By making wax moulds from these plates they may be reproduced in copper by electrotyping.

PHOTO-LITHOGRAPHS.

Various plans were suggested for securing on lithographic stone a photographic impression which could afterward be used for printing the fatty inks. The process of J. W. Osborne, formerly of Melbourne, now of Washington, was made public in 1861, and proved to be a great improvement. It is what is called a "transfer process." A sheet of paper is coated with a solution of albumen, gelatine and bichromate of potash. It is then dried in the dark, and subsequently placed, face down, on a sheet of smooth copper, and passed through a lithographic press in order to glaze and flatten it. It is then exposed under a negative, and afterward coated uniformly with greasy lithographic transfer ink. In order to coagulate the albumen in the film, the paper is now floated, inked side upward, on boiling water. At the same time the unaltered gelatine, which was protected by the opaque portions of the negative, absorbs moisture and swells, leaving the unaltered gelatine, the lines of the picture, depressed. The print is now placed, face upward, on a smooth board and washed off gently with a sponge dipped in water. It is then pinned to the board and the washing is completed with a stream of boiling water. The print is then dried, and the picture is transferred to stone by simply placing it upon the stone, face downward, and passing it through the press. The stone is now ready for lithographic printing in the steam press at the rate of 1000 copies an hour. One hour is sufficient for taking the negative, preparing the transfer and placing it upon the stone.

The picture may, if desired, be transferred to a zinc plate instead of stone.

PHOTO-CAUSTICS.

This name is given to photo-lithographs produced in half-tone by means of a Meisenbach ruled negative.

INK PHOTOS.

This name is given by Sprague, of London, to photo-lithographs in half-tone, prepared by a process which is kept secret. The pictures do not show the decided dotted character of the Meisenbach negative, but are very fine grained and soft.

PHOTO-ELECTROTYPES.

Many processes have been proposed for producing electrotypes from gelatine relief surfaces. Among the most successful are those of Paul Pritsch, of Vienna, 1857; Alphonse L. Poitevin, of Paris, 1862; Paul Emil Placet, of Paris, 1864; W. A. Leggo and G. E. Desbarats, of Quebec, 1865; W. H. Mumler, of Boston,